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The Metaprise, The AKMS, and The Enterprise Knowledge Portal

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Introduction

This is a paper about four terms: The Metaprise, the Artficial Knowledge Management System (AKMS), the Enterprise Information Portal (EIP), and the Enterprise Knowledge Portal (EKP). They're important terms. The Metaprise is short-hand for the 21st Century knowledge-managed, knowledge innovating organization, The AKMS is the name of a comprehensive type of IT application supporting Knowledge Management. It is at the foundation of the KMC's AKMS Standards Sub-Committee. EIP is a new software application and investment space identified by Merrill Lynch. And the EKP is a type of EIP segmenting that space. In this paper I'll lay out the relationships among these terms and develop a concept map including all of them. The map will show the convergence of terminology on a new and, I hope, powerful construct: the Metaprise as the knowledge-managing, knowledge-innovating organization of the 21st Century supported by an Enterprise Knowledge Portal system as its central AKMS application.

The Metaprise

Definition

Figure One provides an overview of a Knowledge Life Cycle model begun in collaboration with Mark McElroy, Edward Swanstrom, Douglas Weidner, and Steve Cavaleri [1], during meetings sponsored by the Knowledge Management Consortium International (KMCI), and further developed recently by Mark McElroy and myself [2]. Knowledge Production and Knowledge Integration are core knowledge processes in the model. Knowledge Production produces Validated Knowledge Claims (VKCs), Unvalidated Knowledge Claims (UKCs), and Invalidated Knowledge Claims (IKCs), and information about the status of these. Organizational Knowledge (OK) is composed of all of the foregoing results of knowledge production. It is what is integrated into the enterprise by the Knowledge Integration process.

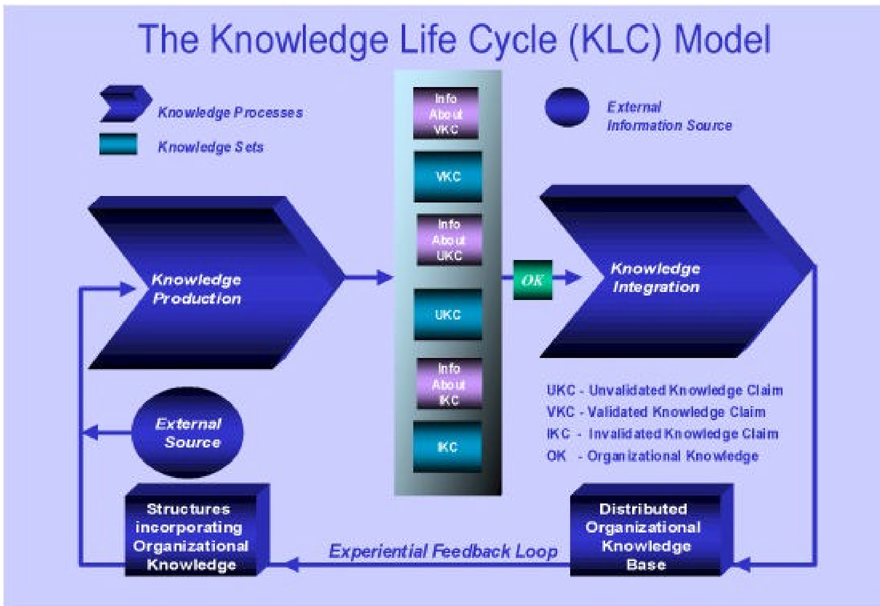

Figure One -- The Knowledge Life Cycle Model (Overview)

The knowledge integration process, in turn, produces the Distributed Organizational Knowledge Base (DOKB) and the DOKB, in its turn, has a major impact on structures incorporating organizational knowledge such as business processes and information systems. Coupled with external sources these structures then feed back to impact Knowledge Production at a later time -- which is why it's called the Knowledge Life Cycle (KLC) model.

Drilling down into knowledge production (figure two), the KLC view is that information acquisition, and individual and group learning, impact on knowledge claim formulation, which, in turn, produces Codified Knowledge Claims (CKCs). These, in their turn, are tested in the knowledge validation sub-process, which produces organizational knowledge. Individual and group learning may involve knowledge production from the perspective of the individual or group, but from the perspective of the enterprise, what the individuals and groups learn is information, not knowledge. Similarly information acquired may be knowledge from the perspective of the external parties it is acquired from.

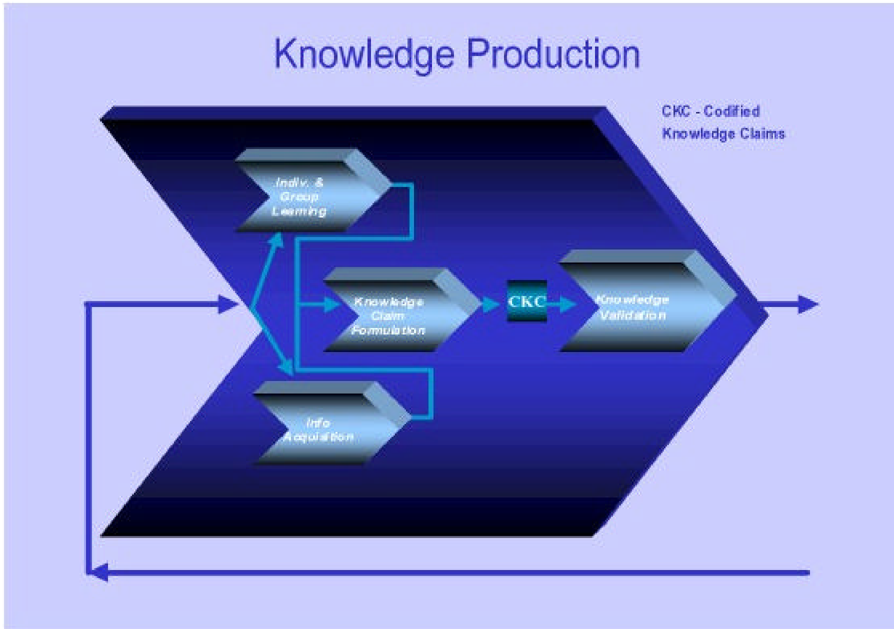

Figure Two -- The Components of Knowledge Production

Drilling down into knowledge integration (figure three), organizational knowledge is integrated across the enterprise by the broadcasting, searching/retrieving, teaching, and sharing sub-processes. These generally work in parallel rather than sequentially. And not all are necessary to a specific instance of the KLC. All may be based in personal non-electronic or electronic interactions.

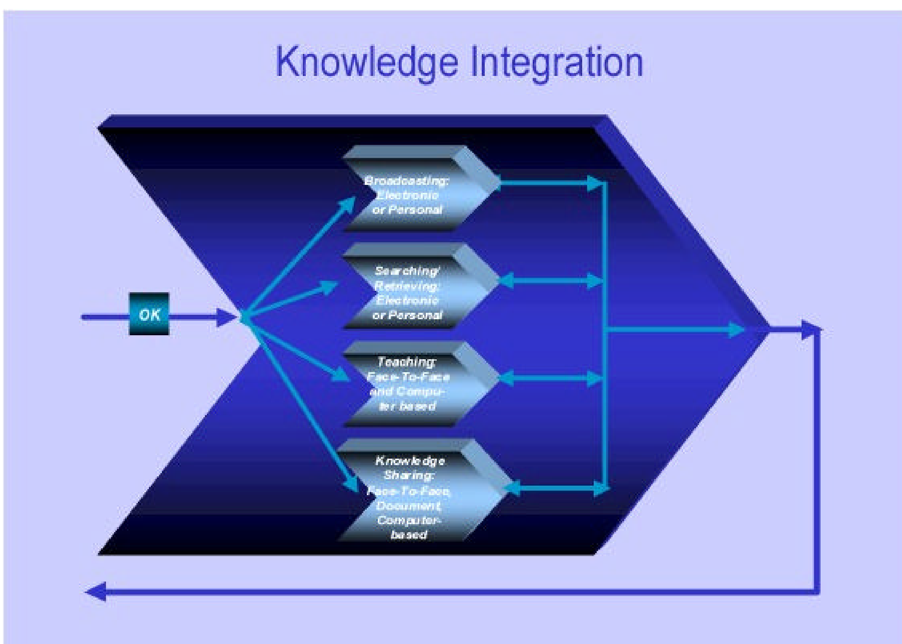

Figure Three -- The Components of Knowledge Integration

Here is a glossary of the major terms used in the KLC Model.

Sidebar One: Glossary for Figures One - Three

Codified Knowledge Claims **-** Information that has been codified, and is claimed to be true, but which has not yet been subjected to organizational validation.

Distributed Organizational Knowledge Base - an abstract construct representing the outcome of knowledge integration. The DOKB is found everywhere in the enterprise, not merely in electronic repositories.

Experiential Feedback Loops **-** Processes by which information concerning the outcomes of organizational learning activities are fed back into the knowledge production phase of an organization's knowledge life cycle as a useful reference for future action.

Individual and Group Learning **-** A process involving human interaction, knowledge claim formulation, and validation by which new individual and/or group level knowledge is created.

Information About Invalidated Knowledge Claims **-** Information that asserts the existence of invalidated knowledge claims and the circumstances under which such knowledge was invalidated.

Information About Unvalidated Knowledge Claims **-** Information thats asserts the existence of unvalidated knowledge claims, and the circumstances under which such knowledge was tested and neither validated nor invalidated.

Information About Validated Knowledge Claims - Information that asserts the existence of validated knowledge claims and the circumstances under which such knowledge was validated.

Information Acquisition **-** A process by which an organization either deliberately or serendipitously acquires knowledge claims or information produced by others external to the organization.

Invalidated Knowledge **-** A collection of codified invalidated knowledge claims.

***Invalidated Knowledge Claims* -** Codified knowledge claims that have not satisfied an organization's validation criteria. Falsehoods.

***Knowledge Claim* -** A codified expression of potential knowledge which may be held as validated knowledge at an individual and/or group level, but which has not yet been subjected to a validation process at an organizational level. Information. Knowledge claims are components of hierarchical networks of rules, that if validated would become the basis for organizational or agent behavior.

***Knowledge Claim Formulation* -** A process involving human interaction by which new organizational knowledge claims are formulated.

***Knowledge Integration* -** The process by which an organization introduces new knowledge claims to its operating environment and retires old ones. Knowledge Integration includes all knowledge transmission, teaching, knowledge sharing, and other social activity that communicates either an understanding of previously produced organizational knowledge to knowledge workers, or the knowledge that certain sets of knowledge claims have been tested, and that they and information about their validity strength is available in the organizational knowledge base, or some degree of understanding between these alternatives. Knowledge integration processes, therefore, may also include the transmission and integration of information.

***Knowledge Production* -** A process by which new organizational knowledge is created, discovered, or made. Synonymous with "organizational learning."

***Knowledge Validation Process* -** A process by which knowledge claims are subjected to organizational criteria to determine their value and veracity.

***Organizational Knowledge* -** A complex network of validated knowledge claims held by an organization, consisting of declarative and procedural rules.

***Organizational Learning* -** A process involving human interaction, knowledge claim formulation, and validation by which new organizational knowledge is created.

(business) Structures Incorporating Organizational

Knowledge - Outcomes of organizational system interaction. The organization behaves through these structures including business processes, strategic plans, authority structures, information systems, policies and procedures, etc. Knowledge structures exist within these business structures and are the particular configurations of knowledge found in them.

Unvalidated Knowledge Claims **-** Codified knowledge claims that have not satisfied an organization's validation criteria, but which were not invalidated either. Knowledge claims requiring further study.

Validated Knowledge Claims **-** Codified knowledge claims that have best satisfied an organization's validation criteria compared to other, competing, knowledge claims. "Truth" as we currently know it.

The Knowledge Management Process (KMP) is an on-going persistent interaction among human-based agents within the Natural Knowledge Management System (NKMS) [3]. The KMP is distinct from other interactions of the NKMS. Agents participating in it aim at integrating its agents, various components, and activities into a planned, directed, unified whole producing, maintaining, enhancing, acquiring, and transmitting the enterprise's knowledge base. Knowledge Management is human activity that is part of the interaction constituting the KMP.

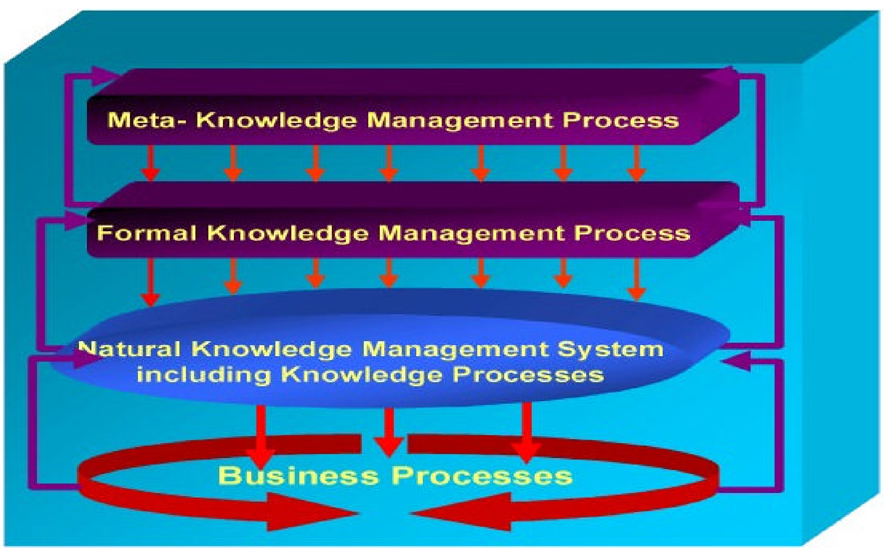

Figure Four -- The Metaprise -- The
Knowledge Managing, Knowledge Innovating Organization

A Metaprise [1] [4] is an organization that has implemented an authoritative and formal Knowledge Management Process that not only manages knowledge processes, but also manages itself and its own rate of innovation. The Metaprise therefore contains at least two legitimated levels of process activity above the knowledge process level. The first analyzes and manages what occurs at the fundamental knowledge process level of interaction, and the second does the same at the knowledge management process level of interaction as well. In short, the Metaprise is the knowledge-managing, knowledge-innovating organization. It is illustrated in Figure Four.

KM as a discipline needs a short hand expression to refer to the knowledge-managing, knowledge innovating organization. The term "Metaprise" is a good choice. It recognizes the existence in some organizations of the "meta" or formal KM activity level over and above the fundamental knowledge process level of interaction, and also the existence of other levels above the KM activity level that manage and control innovation at the KM activity level.

Formal KM activity is activity dedicated to shaping the direction of the NKMS. It is not fundamental knowledge process activity. But it is independent of it and about it. Organizations that have formal KM activity, have taken a deliberate and conscious step toward growing and institutionalizing organizational intelligence, adaptability, creativity, and learning. Assuming their success in implementing their KMP, they are much more nearly 21st Century "intelligent enterprises" than their competitors. But if they implement the KM activity level alone, they are still not Metaprises, but only pre-metaprises. To become a Metaprise, they still must implement at least another level of KM process activity in addition to first level KM. This is necessary to produce new knowledge about knowledge production, or, in other words, to innovate about the rate of innovation

Among Metaprises we can distinguish types along two important dimensions, thereby providing the basis of a useful classification. The first is the number of levels of knowledge management interaction a Metaprise, has implemented. The second is the breadth of knowledge management activities it has implemented at each level.

Levels of Knowledge Management

By levels of knowledge management interaction, I mean to distinguish multiple levels of KM process activity arranged in a hierarchy. In principle, and, at least with respect to knowledge production, the hierarchy has an infinite number of levels [5]. The hierarchy is generated by considerations similar to those specified by Bertrand Russell [6] in his theory of types, and Gregory Bateson [7] in his theory of learning and communication.

Knowledge processes occur at the same level of agent interaction as other business processes. Let's call this business process level of interaction Level Zero of enterprise Complex Adaptive System (cas) interaction [8]. At this level, pre-existing knowledge is used by business processes and by knowledge processes to implement activity. And, in addition, knowledge processes produce and integrate knowledge about business processes using (a) previously produced knowledge about how to implement these knowledge processes, (b) infrastructure, (c) staff, and (d) technology, whose purpose is to provide the foundation for knowledge production and knowledge integration at level zero. But from where does this infrastructure, staff, knowledge, and technology come. Who manages them, and how are they changed?

They don't come from, by and through the level zero knowledge processes -- these only produce, transfer, and acquire knowledge about business processes such as the sales, marketing or manufacturing processes. So, this is where Level One of cas interaction, the lowest level of knowledge management comes in.

This level one KM process interaction is responsible for producing, and integrating knowledge *about* Level Zero knowledge production and integration processes to knowledge workers at Level Zero. It is this knowledge which is used at both Level Zero and Level One to implement knowledge processes and KM knowledge and information processing. Let’s call this level one knowledge the Enterprise Knowledge Management (EKM) model.

The KM process and EKM model at Level One are also responsible for providing the knowledge infrastructure, staff, and technology necessary for implementing knowledge processes at Level Zero. In turn, knowledge processes at Level Zero use this infrastructure, staff, and technology to produce and integrate the knowledge used by the business processes. The relationships between level one KM and level zero knowledge and business processes are illustrated in Figure Five.

Knowledge about level zero knowledge processes, as well as infrastructure, staff, and technology change when level one KMP interactions introduce changes. That is, changes occur: when the level one KMP produces, and integrates new knowledge about how to implement level zero knowledge processes; and when it adds or subtracts from the existing infrastructure, staff, and technology based on new knowledge it produces. There are two possible sources of these changes.

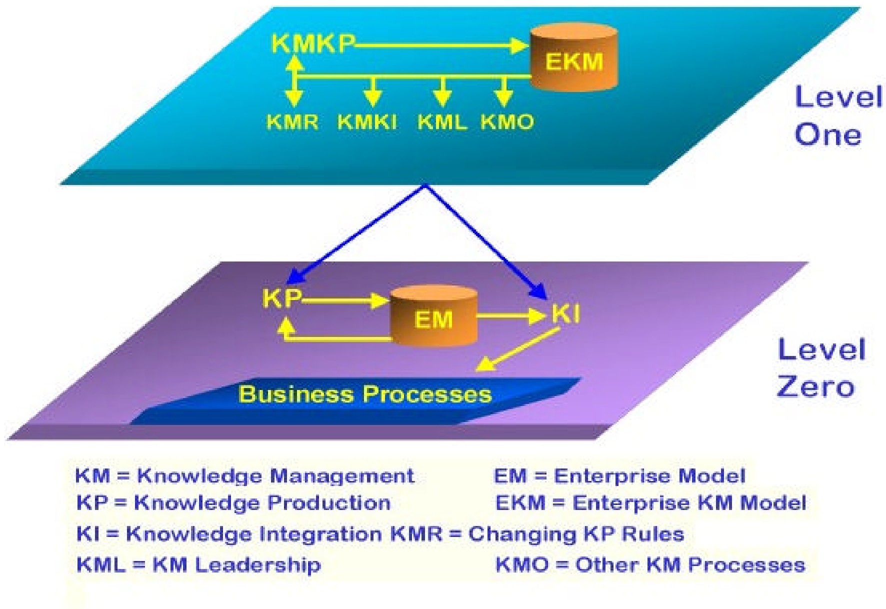

Figure Five -- Level Zero/Level One KM Process Relationships

First, knowledge production at Level One can change the EKM model, which, in turn, impacts on (a) knowledge about how to produce or integrate knowledge about (Level Zero) business processes, (b) knowledge about how to acquire information or integrate knowledge about Level One information acquisition or integration processes (c) staffing, (d) infrastructure, and (e) technology. This type of change then, originates in the KM Level One process interaction itself.

Second, knowledge expressed in the EKM model about how to produce knowledge at Level One may change. This knowledge however, is only *used* in arriving at the Level One EKM model. It is not explained or accounted for by it. It is determined, instead by a KM Level Two process and is accounted for in a Level Two EKM model produced by this interaction. Figure Six adds the KM Level Two process to the process relationships previously shown in Figure Five.

Instead of labeling the three levels of processes discussed so far as Level Zero, Level One, and Level Two, it is more descriptive to think of them as the knowledge process level, the KM or meta-knowledge process level, and the meta-KM level of process interaction. There is no end, in principle, to the hierarchy of levels of process interaction and accompanying EKM models. The number of levels we choose to model and to describe, will be determined by how complete an explanation of knowledge management activity we need to accomplish our purposes.

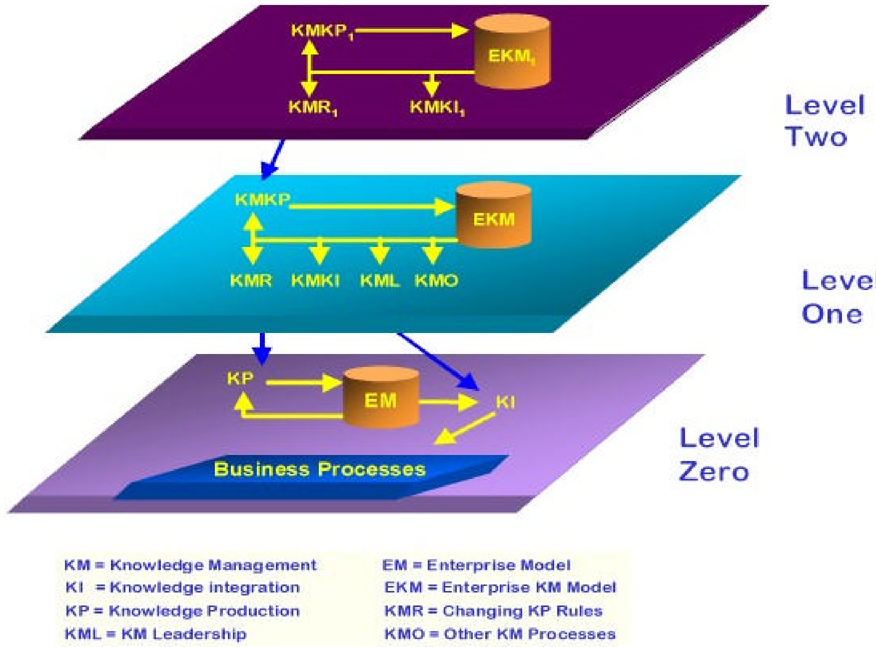

Figure Six -- Level Zero -- Level Two KM Process Relationships

- The knowledge process level produces knowledge about business processes, and *uses knowledge about how to produce (how to innovate) knowledge about business processes.* This level cannot change knowledge about how to produce knowledge. It can change knowledge about business processes.

- The KM (pre-metaprise, meta-knowledge) process level produces the knowledge about how to produce knowledge about business processes, and *uses knowledge about how to produce KM level knowledge about how to produce knowledge about business processes.* This level can change knowledge about how to produce knowledge, but cannot change knowledge about how to produce KM-level knowledge.

- The meta-KM (first Metaprise level) produces: (a) knowledge about how to produce knowledge about KM knowledge processes, and (b) knowledge about how to produce KM level knowledge about how to produce knowledge about knowledge processes. *It uses knowledge about how to produce Meta-KM level knowledge about how to produce knowledge about KM knowledge processes.* This level can change knowledge about how to produce KM-level knowledge, but cannot change knowledge about how to produce Meta-KM level knowledge.

- Level Three, the meta-meta-KM process level of interaction produces knowledge about how to produce Meta-KM level-produced knowledge about how to produce knowledge about KM knowledge processes, and *uses Meta-Meta KM level-produced knowledge about how to produce* *knowledge about Meta-KM level knowledge processes.* This level can change knowledge about how to produce Meta-KM level knowledge, but cannot change knowledge about how to produce Meta-Meta KM level knowledge.

Level Three then, seems to be the minimum number of levels needed for a view of KM allowing one to change (accelerate) the rate of change in KM level knowledge. And in some situations, where we need even more leverage over our knowledge about how to arrive at knowledge about KM processes, we may even need to go to a fourth (meta-meta-meta-) KM level.

Distinctions among metaprises according to the Level of Knowledge Management practiced in them, lets us talk about pre-Metaprises, Level One Metaprises, Level Two Metaprises and so on. It should be possible to usefully characterize the successful 21st century intelligent enterprise, at least on a business domain specific basis, as a Level X Metaprise, when we have more empirical evidence on how many KM levels are needed for competitiveness in any business domain.

Thus, the relative effectiveness of Metaprises at different levels is an empirical question, not something we should assume as given. While it's very likely that effectiveness will increase as Metaprises move from Level One to higher levels, there may be a point at which diminishing returns set in. Or there may even be a point at which movement up the ladder of levels leads to negative returns relative to the investment required to add a KM level, or leads to fewer returns than alternative investments in other areas. ROI considerations must apply to Metaprise KM enhancements, as well as to other Metaprise business processes.

Breadth of KM Processes

By breadth of knowledge management processes, I mean the extent to which all of the major KM activities are implemented at any specified level of the Metaprise. So what are these major KM activities? Here's a conceptual framework that begins to specify them.

- Business process activities may be viewed as sequentially linked and as governed by validated rule sets, or knowledge. [1] [3] [9] [10]
- A linked sequence of activities performed by one or more agents sharing at least one objective is a Task.
- A linked sequence of tasks governed by validated rule sets, producing results of measurable value to the agent or agents

performing the tasks is a Task Pattern.

- A cluster of task patterns, not necessarily performed sequentially, often performed iteratively and incrementally, is a Task Cluster.
- Finally, a hierarchical network of interrelated, purposive, activities of intelligent agents that transforms inputs into valued outcomes, a cluster of task clusters, is a business process.

The activity to business process hierarchy is illustrated in Figure Seven.

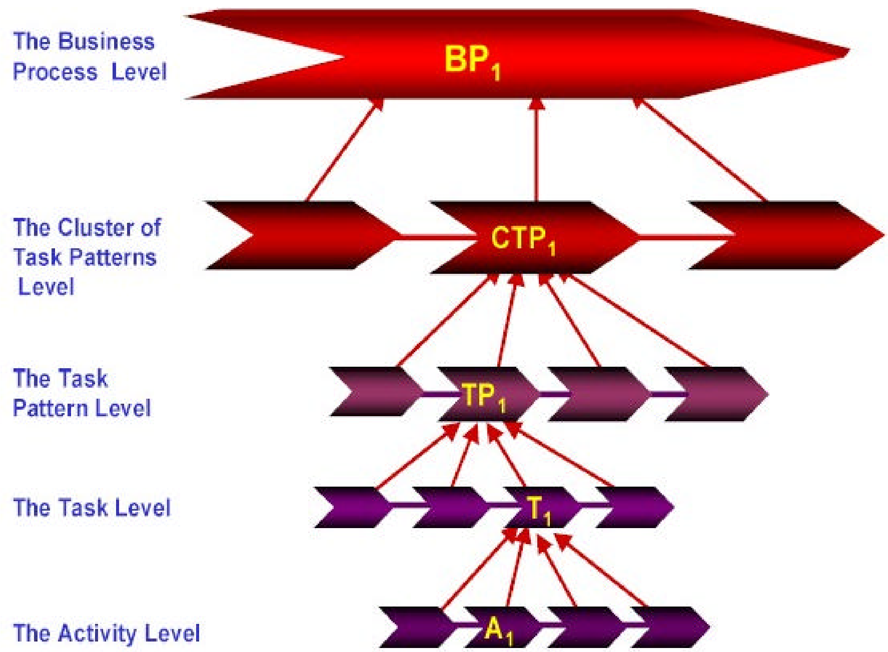

Figure Seven -- The Activity To Business Process Hierarchy

This hierarchy, ranging from activities to processes, applies to knowledge and KM processes as well as to operational business processes. Enterprise KM activities may be usefully categorized according to a scheme of task clusters which, with some additions and changes, generally follows Mintzberg [11]. There are three types of KM task clusters: interpersonal behavior, information (and knowledge) processing behavior, and decision making. Each type of task cluster is broken down further into more specific types of task pattern activities in the text below.

Interpersonal Behavior

- Interpersonal Behavior includes *figurehead* or ceremonial KM activity. This activity focuses on performing formal KM acts such as signing contracts, attending public functions on behalf of the enterprise's KM process, and representing the KM process to dignitaries visiting the enterprise.

- A second type of interpersonal activity is *leadership*. This includes hiring, training, motivating, monitoring, and evaluating staff. It also includes persuading non-KM agents within the enterprise of the validity of KM process activities. That is, KM activity includes building political support for KM and knowledge processes within the enterprise.

- A third type of interpersonal KM activity is *building relationships with individuals and organizations external to the enterprise*. This is another political activity designed to build status for KM and to cultivate external sources of support for KM.

Knowledge and Information Processing

- *Knowledge Production* is a KM as well as a knowledge process. KM knowledge production is different in that it is here that the rules for knowledge production that are used at the level of knowledge processes are specified. Keep in mind that knowledge production at this level involves planning, descriptive, cause-and-effect, predictive, and assessment knowledge about the two fundamental level zero knowledge processes, as well as these categories of knowledge about level one interpersonal, knowledge integration, and decision making KM activities. The only knowledge not produced by level one knowledge production, is knowledge about how to accomplish knowledge production at Level One. Once again, the rules constituting this last type of knowledge are produced at Level Two.

- KM *Knowledge Integration* is affected by KM knowledge production, and also affects knowledge production activities by stimulating new ones. KM knowledge integration at any KM level also plays the critical role of diffusing "how-to" knowledge to lower KM and knowledge process levels.

Decision Making Activities

- *Changing knowledge process rules* at lower KM and knowledge process levels. Essentially this involves making the decision to change such rules and causing both the new rules and the mandate to use them to be transferred to the lower level.

- *Crisis Handling* would involve such things as meeting CEO requests for new competitive intelligence in an area of high strategic interest for an enterprise, and directing rapid development of a KM support infrastructure in response to requests from high level executives,

- *Allocating Resources* for KM support infrastructures, training, professional conferences, salaries for KM staff, funds for new KM programs, etc.

- *Negotiating* agreements with representatives of business processes over levels of effort for KM, the shape of KM programs, the ROI expected of KM activities, etc.

Altogether, there are *nine* KM activities in the three task clusters. This classification is probably not complete. There are likely other activities, as well as other task clusters I have overlooked. When we come up with a better classification, we will then have the capability to define types of Metaprises based on both variation in levels of KM, and in the breadth of KM task clusters and activities that are implemented. This should give us a fairly rich two-dimensional classification of Metaprises, which we can then further segment by performance and other characteristics as seems appropriate.

<u>The Artificial Knowledge Management System (AKMS)</u>

The AKMS supports the NKMS of the Metaprise, along with its formal knowledge Management process. It is designed to manage the integration of computer hardware, software, and networking objects/components into a functioning whole, supporting enterprise knowledge production, and integration processes. The AKMS, in other words, supports producing, and integrating the enterprise's knowledge base. The enterprise's knowledge base, in turn, is used by its agents to perform Knowledge, Knowledge Management, and other business processes.

I’ve defined and described the AKMS and its key component, the Artificial Knowledge Manager (AKM) in more detail elsewhere [12]. The basic architecture of the AKMS has been developed in a "strawman" version by the Knowledge Management Consortium (KMC) and is illustrated in Figure Eight.

It shows clients, application servers, communication buses and data stores integrated through a single logical component called an Artificial Knowledge Manager (AKM). The AKM performs its central integrative functions by providing process control and distribution services, an Active, In-memory Object Model supplemented by a persistent object store, and Connectivity Services to provide for passing data, information, and knowledge from one component to another. A more concrete visual picture showing the variety of component types in the AKMS, is provided in Figure Nine.

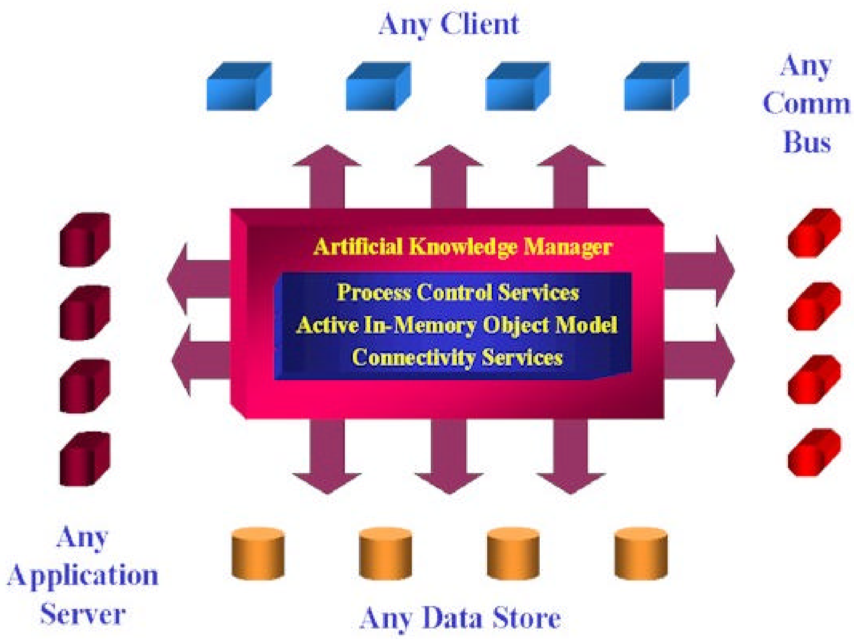

Figure Eight -- KMC "Straw Man" AKMS Architecture

Figure Nine -- Components of the AKMS

Sidebar Two: Figure Nine Abbreviations

Web = Web Information Server

Pub = Publication & Delivery Server

KDD = Knowledge Discovery in Databases/ Data Mining Servers

ETML = Extraction, Transformation, Migration and Loading

DDS = Dynamic Data Staging Area

DW = Data Warehouse

ODS = Operational Data Store

ERP = Enterprise Resource Planning

Query = Query and Reporting Server

CTS = Component Transaction Server

BPE = Business Process Engine

ROLAP = Relational Online Analytical Processing

An important difference between the two figures is that the communications bus aspect of the AKMS is implicit in Figure Nine, where I have assumed that the AKM incorporates it. The AKM provides the computing framework necessary to dynamically integrate the Metaprise's computing support for KM activities and processes. Figure Nine makes plain the diversity of component types in the Metaprise's AKMS. It is because of this diversity and its rapid rate of growth in the last few years that the AKM becomes necessary. Change in the AKMS's components and objects can be introduced through so many sources that if the AKMS is to adapt to change, it needs an integrative component like the AKM to play the major role in its integration and adaptation.

The Key Architectural Components of the AKMS are:

- The Artificial Knowledge Manager (AKM);
- Stateless Application Servers;
- Application Servers that maintain State;
- Object/Data Stores;
- Object Request Brokers (e.g., CORBA, DCOM); and
- Client Application Components.

In order to provide the flavor of the AKMS I'll briefly describe these various components (with the exception of client application components) below.

<u>The AKM</u>

An AKM provides Process Control Services, an Object Model of the Artificial Knowledge Management System (AKMS) (the system corresponding to the AKMS architecture), and Connectivity to all metaprise information, data stores, and applications. What I mean by these terms is covered in detail in [12]. Here a brief outline should provide at least a flavor of the AKM sufficient to develop AKMS connections to the Metaprise and Enterprise Knowledge Portals.

Process Control Services include:

- In-memory proactive object state management and synchronization across distributed objects and through intelligent agents;
- Component management and work flow management through intelligent agents
- Transactional multi-threading;
- business rule management and processing; and
- metadata management.

An In-memory Active Object Model/Persistent Object Store is characterized by:

- Event-driven behavior;
- AKMS-wide model with shared representation;
- Declarative as well as procedural business rules;
- Caching along with partial instantiation of objects;
- A Persistent Object Store for the AKM;
- Reflexive Objects.

Connectivity Services should have:

- Language APIs: C, C++, Java, CORBA, COM;
- Databases: Relational, ODBC, OODBMS, hierarchical, network, flat file, etc.;
- Wrapper connectivity for application software: custom, CORBA, or COM-based; and
- Applications connectivity including all the categories mentioned in Figure Nine above, whether these are mainframe, server, or desktop - based.

Application Servers

The development of multi-tier distributed processing systems was characterized by the appearance of application servers such as component transaction servers and web application servers. Application servers provide services to other components in a distributed processing system by executing business logic and data logic on data accessed from database servers.

The class of application servers is sub-divided by Rymer’s [13] distinction between "stateless" and in-memory server environments. Application Servers with Active in-memory Object Models he calls Business Process Engines (BPEs), a name similar to Vaskevitch's [14] Business Process Automation Engines.

Stateless Application Servers

According to Rymer: "Business state is the information that describes the momentary status of the organization. To create business state, most applications acquire data from a database and then load it into memory for manipulations by the user." [13, P. 1] This is the "stateless" approach because, in it, a back-end database, rather than internal memory, manages state.

Among stateless application servers Rymer distinguishes:

- Web Information Servers (they provide access to databases from web browsers)
- Component Servers (they "provide data access and interaction frameworks for software components"); and
- Transaction Processing Monitors (they coordinate transactions within a distributed system).

Business Process Engines: Application Servers that Maintain State

"Business Process Engines manage the most important business state both in a fast in-memory environment and in close coordination with back-end databases." [13, P. 1] Because of their in-memory maintenance of state, BPEs process many user requests without help from a database. In addition, they specialize in complex business rule processing, because their ability to maintain state is a special advantage in performing such processing.

KM software applications such as KDD/data mining servers, publication and delivery servers, the AKM itself, and many other server types are all BPEs. The job of the AKMS is to integrate the burgeoning list of BPEs into an enterprise wide system.

Therefore, an important aspect of specifying the AKMS is specifying the current universe of application servers and projecting the appearance of new types. Here are some criteria for defining types of Business Process Engines:

- whether they are distributed across physical components or not;
- whether a BPE application server deals with a single or multiple business processes; and
- the business process the BPE supports.

Distributed BPEs can be a powerful tool for upgrading performance in AKMSs, as well as for integrating their various components. An AKM is just a BPE that is both distributed and encompasses all of an AKMS's processes. A multi-process BPE can fall short of being an AKM, and instead can be restricted to a cluster of related processes. So, there are at least three types suggested by this criterion: a single process BPE, a BPE cluster, and an AKM.

How well a multi-process BPE performs will be correlated to the extent of its distribution, and to the complexity of the process it must support. But holding complexity constant, single process, non-distributed BPEs will generally perform better than multi-process non-distributed BPEs. So, multi-process BPEs will generally be distributed BPEs.

The third criterion for classifying BPEs is the business process supported. Here is an incomplete classification of BPE application servers based on knowledge, KM and Data Warehousing sub-processes:

- Collaborative Planning; Extraction, Transformation, and Loading (ETL);
- Knowledge Discovery in Databases (KDD);
- Knowledge base/object/component model maintenance and change management (The AKM);
- Knowledge Publication and Delivery (KPD);
- Computer-Based Training (CBT);
- Report Production and Delivery (RPD);
- ROLAP;
- Operational Data Store (ODS) Application Server;
- Forecasting/Simulation;
- Enterprise Resource Planning;
- Financial Risk Management;

- Telecommunications Service Provisioning;
- Transportation Scheduling;
- Stock Trading; and
- Work Flow.

It should be apparent from the list that BPEs, when integrated with an AKM, can broadly support knowledge and KM process activities and task clusters in the Metaprise.

Object/Data Stores

There are few, if any, limits on the types of object/data stores in the AKMS. These stores incorporate data, objects, components, or their attributes in a non-volatile persistent form. Legacy data, flat files, Relational Databases, Object Relational Databases, OODBMSs, multidimensional data stores, and vertical technology databases all fit within the AKMS.

In addition, the AKMS must also integrate Image, Text, Report, Video, Audio, and File Document Types. That is, it is the job of the AKMS to develop and maintain connectivity to various information stores, and not simply structured DBMSs. It is also the job of the AKMS to manage the new forms of content produced from various information stores, and to amalgamate unstructured content with structured data.

The unlimited character of AKMS object/data stores is critical to AKMS support for Metaprise KM activities and task clusters. KM tasks are not limited only to those that require support from relational databases or even structured databases. They require access to all of the different types of information present in the metaprise. Only an application such as the AKMS that can provide such access can adequately support the Metaprise.

Object Request Brokers (ORBs)

ORBs provide an intermediate layer between clients and servers in a distributed network. The ORB receives requests from clients and selects servers to satisfy the requests. The ORB can activate appropriate servers. The ORB can translate data between clients and servers. Generally, ORB servers are stateless and therefore are not BPEs (though this is not a necessary consequence of ORB specifications).

The AKM must support CORBA and DCOM ORBs to fulfill its integrative function, and therefore its comprehensive support role in the Metaprise. That is, it must be able to act as both CORBA and DCOM Servers and

Clients. In this way, the AKM, with its greater integrative functionality, is built "on top of" an ORB standard.

Enterprise Information Portals (EIPs) and Enterprise Knowledge Portals (EKPs)

EIPs

In November of 1998, a new "investment space" called Enterprise Information Portals (EIPs), was declared by Christopher Shilakes and Julie Tylman of Merrill Lynch's Enterprise Software Team [15, P. 1].

"Enterprise Information Portals are applications that enable companies to unlock internally and externally stored information, and provide users a single gateway to personalized information needed to make informed business decisions. " They are: ". . . an amalgamation of software applications that consolidate, manage, analyze and distribute information across and outside of an enterprise (including Business Intelligence, Content Management, Data Warehouse & Mart and Data Management applications.)"

Merrill Lynch sees EIPs as the next big investment opportunity in the IT sector and believes the EIP space will eventually reach or exceed the size of the Enterprise Resource Planning Market. Here are the essential characteristics of EIP’s according to Shilakes and Tylman [15, Pp. 10-13]:

- EIPs use both "push" and "pull" technologies to transmit information to users through a standardized web-based interface;

- EIPs provide "interactivity" – the ability to " ‘question’ and share information on" user desktops;

- EIPs integrate disparate applications including Content Management, Business Intelligence, Data Warehouse/Data Mart, Data Management, and other data external to these applications into a single system that can "share, manage and maintain information from one central user interface." An EIP is able to access both external and internal sources of data and information. It is able to support a bi-directional exchange of information with these sources. And it is able to use the data and information it acquires for further processing and analysis;

- EIPs exhibit the trend toward "verticalization" in application software. That is, they are often "packaged applications" providing "targeted content to specific industries or corporate functions."

Content Management Systems process, filter, and refine "unstructured" internal and external data and information contained in diverse paper and electronic formats, archive and often restructure it, and store it in a corporate repository (either centralized or distributed). Business Intelligence tools access data and information and through Querying, Reporting, On-Line Analytical Processing (OLAP), Data Mining, and Analytical Applications provide a view of information both presentable and significant to the end user. Data Warehouses and Data Marts are integrated, time-variant, non-volatile collections of data supporting DSS and EIS applications, and, in particular business intelligence tools and processes. And Data Management Systems "perform ETL tasks, clean data, and facilitate scheduling, administration and metadata management for data warehouses and data marts."

EKPs

An EKP is a type of EIP. It is an EIP that:

- is goal-directed toward knowledge production, knowledge acquisition, knowledge transmission, and knowledge management focused on enterprise business processes, e.g., sales, marketing, and risk management, and also

- focuses upon, provides, produces, and manages information about the validity of the information it supplies.

Knowledge Portals, in other words, provide information about your business, and also supply you with meta-information about what information you can rely on for decision making. EKPs, therefore, distinguish knowledge from mere information. And they provide a facility for producing knowledge from data and information, in addition to providing mere access to data and information.

EKPs, moreover, orient one toward producing, acquiring and transmitting knowledge as opposed to information. Intrinsically then, they provide a better basis for making decisions than do EIPs generally. Those who have knowledge, have a competitive advantage over those who have mere information.

The Metaprise and The AKMS

The relationship between knowledge processes, and the KMP in the Metaprise, and the AKMS is illustrated in Figure Ten. Specifically, the AKMS assists the Metaprise in performing both knowledge processes and the KMP. That is, the use cases of the AKMS support tasks implementing both knowledge processes and the KMP through the behavior of the AKMS components illustrated in abstract form in Figures Eight and Nine. The Metaprise cannot successfully perform its KM activities without support from the AKMS. The Knowledge Discovery and Data Mining Activities of the Metaprise's human agents would be ineffective without the support provided by AKMS KDD/Data Mining components. Knowledge Retrieval activities would also be crippled, as would data cleansing, extraction, and loading, and numerous other activities.

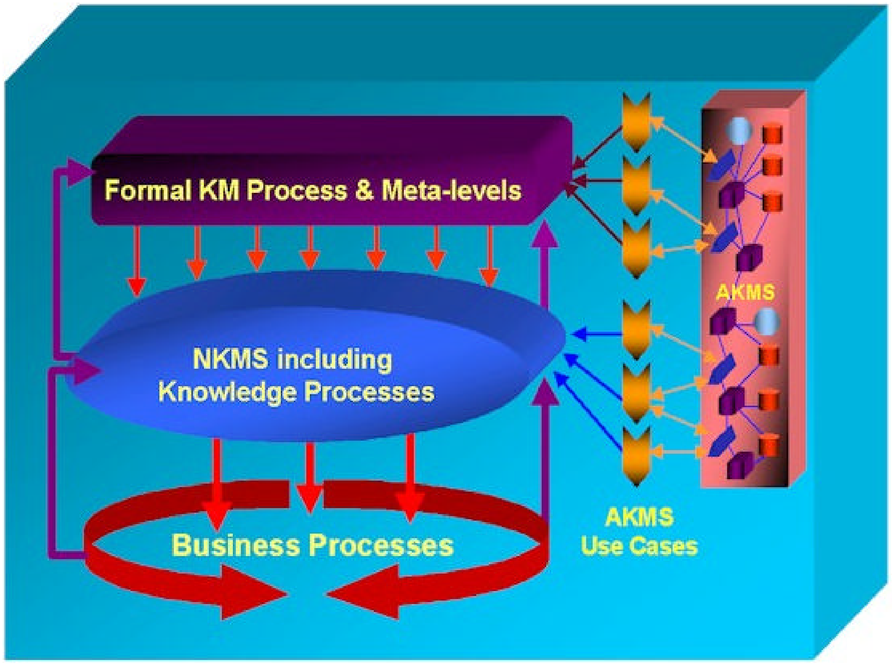

Figure Ten -- The Metaprise and The AKMS

I've provided a detailed listing of the knowledge process and KM activities of the NKMS supported by the AKMS in [3] and [12]. But the most important support the AKMS provides to the Metaprise, is support for the management of change and adaptation in Metaprise knowledge and KM processes. Through its capability to perform KDD/Data Mining, and its pro-active object model, along with process control services such as:

- In-memory proactive object state management and synchronization across distributed objects and through intelligent agents;
- Component management and work flow management through intelligent agents
- Transactional multi-threading;
- business rule management and processing; and
- metadata management,

The AKMS provides an increased adaptive capacity that the Metaprise needs in order to grow and evolve its knowledge over time. Part of the penumbra of meaning attaching to the Metaprise is the notion of organizational intelligence – the capacity to solve problems and to learn. This capacity is provided to the Metaprise in the end, through the personal growth and interaction of its human agents. But this growth and interaction is greatly enhanced by the AKMS, the future of computing resources of the 21st century organization called the Metaprise.

Conclusion: The Metaprise, The AKMS, and The EKP

In previous Papers and Briefs I've given a lot of attention to defining and characterizing Artificial Knowledge Management Systems (AKMS) [3][12], and Distributed Knowledge Management Systems (DKMS) [16] [17] [18]. The AKMS is the more general formulation and refers to an enterprise wide conceptually distinct integrated component produced by the NKMS of an enterprise. The DKMS is a specific type of AKMS designed to manage the integration of distributed computer hardware, software, and networking objects/components into a functioning whole supporting enterprise knowledge production, acquisition, and transfer processes. It is the concrete manifestation of the AKMS given current technology. In [17], [19], [20], and [12], I've developed DKMS/AKMS architectural concepts and related those to the characteristics of the Artificial Knowledge Manager (AKM), the integrative layer in the DKMS.

So, how is the EKP related to the DKMS/AKMS concepts and to the Metaprise?

An EKP shares the DKMS's complexity with respect to diversity of data and information stores, and application servers. EKPs, since they are a type of EIP, integrate Data Warehouses and Data Marts, other structured database applications, Content Management Applications including web publishing and multimedia applications, Data Management Applications, and Business Intelligence Applications, including data mining, analytical applications, ROLAP, MOLAP, DOLAP, Enterprise Level Reporting, and Web-based Delivery of all information and applications. My earlier description of the AKMS/DKMS structure specifies virtually identical content including business process engines embodying the component applications of EKP/EIP systems.

Unlike the EIP, in which there no intrinsic requirement to manage or implement criteria used to test and validate produced or acquired information, an EKP also shares with the AKMS its goal-directedness toward improved knowledge production, knowledge integration, and knowledge management. It also shares with it a focus on information about the validity of claimed knowledge.

Finally, EKPs share the Dynamic Integration Problem with the AKMS/DKMS, and, unlike EIPs, also share the requirement that the DIP be managed through an integrative object layer with an intrinsic requirement to manage or implement criteria used to test and validate information. Such an integrative object layer is, of course, the AKM.

In sum then, the EKP construct shares the distinctive characteristics of the AKMS/DKMS, its complexity and diversity, its focus on knowledge and validation, and its provision of comprehensive dynamic integration services through an AKM. EKP applications therefore, are instances of AKMS/DKMS applications. And a comprehensive Metaprise wide EKP application, if implemented with an effective AKM, is, simply, another name for the AKMS of that Metaprise. So, in the end an essential handmaiden of the Metaprise, the 21st century knowledge-managed organization is the Enterprise Knowledge Portal. And much of the story of making the Metaprise a reality, will be successfully implementing knowledge portals, a task that is only just beginning.

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Biography

Joseph M. Firestone, Ph.D. is an Information Technology consultant working in the areas of Decision Support (especially Enterprise Knowledge Portals, Data Warehouses/Data Marts, and Data Mining), and Knowledge Management. He is consulting in the areas of developing Enterprise Information/Knowledge Portal Products, and is the author of "Approaching Enterprise Information Portals," a comprehensive, full-length industry report on this rapidly emerging field. In addition, he formulated and is promoting the concept of Distributed Knowledge Management Systems (DKMS) as an organizing framework for software applications supporting Natural Knowledge

Management Systems. Dr. Firestone is Chief Scientist of Executive Information Systems, Inc. (EIS), and one of the founding members of the Knowledge Management Consortium, International. A sampling of his writings may be found at the EIS web site at http://www.dkms.com, a site Dr. Firestone developed. The dkms.com web site is one of the more popular sites in data warehousing and knowledge management, and has now attained a run rate of more than 70,000 visits per year.